Instructions

Q1. In an adiabatic process, no transfer of heat takes place between system and surroundings. Choose the correct option for free expansion of an ideal gas under adiabatic condition from the following. **1 Mark**

A $q = 0,\ \Delta T \neq 0,\ w = 0$
B $q \neq 0,\ \Delta T < 0,\ w = 0$
C $q = 0,\ \Delta T = 0,\ w = 0$
D $q = 0,\ \Delta T < 0,\ w \neq 0$

Q2. Actual flame temperature is always lower than the adiabatic flame temperature, because there is _____: **1 Mark**

A no possibility of obtaining complete combustion at high temperature.
B always loss of heat from the flame.
C both (a) and (b).
D neither (a) nor (b).

Q3. In the given reaction, $H_2(g) \rightarrow 2H(g)$; $\Delta H = 435.0 kJ\ mol^{-1}$ **1 Mark**
The enthalpy change is known as:

A Enthalpy of formation.
B Enthalpy of atomisation.
C Bond dissociation enthalpy.
D Both (b) and (c).

Q4. Therm is the unit of: **1 Mark**

A Heat **B** Temperature **C** Thermometry **D** Work

Q5. In which of the processes, does the internal energy of the system remain constant? **1 Mark**

A Adiabatic **B** Isochoric **C** Isobaric **D** Isothermal

Q6. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: Absolute value of internal energy of a substance cannot be determined.
Reason: It is impossible to determine exact values of constitutent energies of the substances.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false.
D Both Assertion and Reason are false.

Q7. Which of the following drives spontaneous reactions? **1 Mark**

A Low enthalpy values and high entropy values.
B Low enthalpy values and low entropy values.
C High enthalpy values and low entropy values.
D High temperatures and low pressures.

Q8. The laws of thermodynamics speak about: **1 Mark**

A Rates of chemical changes
B Feasibility and energy transformations of a Process
C Both the rate and energy changes of a process
D Energy changes in chemical reactions only

Q9. The pressure-volume work for an ideal gas can be calculated by using the expression **1 Mark**
$w = -\int_{V_t}^{V_f} p_{ex} dV$ .The work can also be calculated from the PV– plot by using the area under the curve within the specified limits. When an ideal gas is compressed (a) reversibly or (b) irreversibly from volume V_i to V_f . choose the correct option.

A w (reversible) = w (irreversible).
B w (reversible) < w (irreversible).
C w (reversible) > w (irreversible).
D w(reversible) = w (irreversible) $+p_{ex}.\Delta V.$

Q10. For the reaction, $X_2O_4(l) \rightleftharpoons 2XO_2(g)\ \Delta U = 2.1K\ cal,\ \Delta S = 20cal\ K^{-1}$ at 300K, Hence ΔG is: [h = 2cal]. **1 Mark**

A 2.7K cal **B** -2.7K cal **C** 9.3K cal **D** -9.3K cal

Q11. On the basis of thermochemical equations (a), (b) and (c), find out which of the algebric relationships given in options (i) to (iv) is correct. **1 Mark**

1. $C(graphite) + O_2(g) \rightarrow CO_2(g); \Delta_r H = xkJ\ mol^{-1}$
2. $C(graphite) + \frac{1}{2}O_2(g) \rightarrow CO(g); \Delta_r H = ykJ\ mol^{-1}$
3. $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g); \Delta_r H = zkJ\ mol^{-1}$

A z = x + **B** x = y – **C** x = y + z **D** y = 2z – x

Q12. Which of the following statement is correct for the reaction? **1 Mark**
CaO(s) + CO_2(g) → $CaCO_3$(s); $\Delta_r H^\circ = -178.3kJ\ mol^{-1}$

A $\Delta_r H^\circ$ is the enthalpy of formation of $CaCO_3$ **B** $\Delta_r H^\circ$ is not the enthalpy of formation of $CaCO_3$
C $\Delta_r H^\circ$ is the enthalpy of combustion of $CaCO_3$ **D** None of the above.

Q13. What is the free energy change △G, when 1.0 mole of water at 100oC and 1 atm pressure is converted steam at 100oC and 1 atm pressure:- **1 Mark**

A +540 cal **B** -9800 cal **C** +9800 cal **D** 0 cal

Q14. The spontaneity of a reaction is indicated by: **1 Mark**

A Enthalpy change **B** Entropy change
C Gibbs free energy change **D** Activation energy
E Specific heat capacity

Q15. The most abundant element in the universe is thought to be: **1 Mark**

A Hydrogen **B** Carbon **C** Oxygen **D** Nitrogen

Q16. The resultant heat change in a reaction is the same whether it takes place in one or several stages. This statement is called: **1 Mark**

A Lavoisier and Laplace law **B** Hess's law
C Joule's law **D** Le-chatelier's principle

Q17. Maximum entropy will be in which of the following? **1 Mark**

A Ice. **B** Liquid water. **C** Snow. **D** Water vapour.

Q18. nternal energy of an ideal gas depends on: **1 Mark**

A pressure **B** temperature **C** volume **D** none of these

Q19. Which of the following conditions is/ are applied for the measurement made in calorimeter? **1 Mark**

A Constant volume, q_v. **B** Constant pressure, $q_{p.}$
C Constant temperature, q_T. **D** Both (a) or (b).

Q20. Enthalpy of sublimation of a substance is equal to: **1 Mark**

A Enthalpy of fusion + enthalpy of vaporisation. **B** Enthalpy of fusion.
C Enthalpy of vaporisation. **D** Twice the enthalpy of vaporization.

Q21. Which of the following are state functions? **1 Mark**

A Enthalpy. **B** Heat. **C** Free energy. **D** Work.

Q22. "The change of enthalpy of a chemical reaction is the same whether the reaction takes place in one step or in several steps". This law was presented by: **1 Mark**

A Hess **B** La Chatelier **C** Kirchhoff **D** Lavoisier and Laplace

Q23. Two samples of DNA, A and B have melting points 340K and 350K respectively. This is because: **1 Mark**

A B has more GC content than A
B A has more GC content than B
C B has more AT cotent than A
D both have same AT content

Q24. For the process, $H_2O(l) \rightarrow H_2O(g)$ at T = 100°C and 1 atm, the correct choice is: **1 Mark**

A $\Delta S_{System} > 0$ and $\Delta S_{Surr} < 0$
B $\Delta S_{System} > 0,\ \Delta S_{Surr} > 0$
C $\Delta S_{System} < 0$ and $\Delta S_{Surr} > 0$
D $\Delta S_{System} < 0,\ \Delta S_{Surr} < 0$

Q25. Which of the following is an extensive property? **1 Mark**

A Temperature. **B** Density. **C** Gibbs free energy. **D** Molar volume.

Q26. If a △Go for a given reaction is known one may determine all the following except the: **1 Mark**

A Direction of Spontaneoun change at the standard condition
B Position of equilibrium at temperature for which △Go is known
C Usefulness of catalyst in controlling the reaction
D Maximum amount of useful work that can be produced at standard condition.

Q27. Which of the following is not true about a reversible reaction? **1 Mark**

A The reaction does not proceed to completion
B It cannot be influenced by a catalyst
C Number of moles of reactants and products is always equal
D It can be attained only in a closed container

Q28. A reaction, A + B + C + D + q is found to have a positive entorpy change. The reaction will be: **1 Mark**

A Possible at high temperature.
B Possible only at low temperature.
C Not possible at any temperature.
D Possible at any temperature.

Q29. A bomb calorimeter is used to measure the value of heat of reaction at a constant: **1 Mark**

A Volume **B** Pressure **C** Temperature **D** None of these

Q30. Entropy is: **1 Mark**

A A thermodynamic concept.
B A state function.
C Independent of path.
D All of the above.

Q31. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: At constant temperature and pressure whatever heat absorbed by the system is used in doing work.
Reason: Internal energy change is zero.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false.
D Both Assertion and Reason are false.

Q32. In the given reaction, $Na(s) \rightarrow Na(g)$ **1 Mark**
The enthalpy of atomisation is same as the:

A Enthalpy of dissociation.
B Enthalpy of sublimation.
C Enthalpy of association.
D Enthalpy of vaporisation.

Q33. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: The value of enthalpy of neutralization of weak acid and strong base is numerically less than 57.1 kJ.
Reason: All the OH– ions furnished by 1 g equivalent of strong base are not completely neutralized.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false.
D Both Assertion and Reason are false.

Q34. Hess's law deals with: **1 Mark**

A Heat changes in a chemical reaction. **B** Rate of reaction
C Equilibrium constant **D** Influence of pressure on volume of a gas

Q35. The standard enthalpies of formation of $CO_2(g)$, $H_2O(l)$ and glucose(s) at 25°C are -400kJ/ mol, -300kJ/ mol and -1300kJ/ mol^{-1} respectively. The standard enthalpy of combustion per gram of glucose of 25°C is: **1 Mark**

A +2900kJ **B** -2900kJ **C** -16.11kJ **D** +16.11kJ

Q36. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: An exothermic process which is non- spontaneous at high temperature may become spontaneous at a low temperature.
Reason: There occurs a decrease in entropy factor as the temperature is decreased.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false.
D Both Assertion and Reason are false.

Q37. For both reversible and irreversible expansion of an ideal gas, under isothermal condition, **1 Mark**

A $\Delta U = 0, \Delta S_{total} \neq 0$ **B** $\Delta U \neq 0, \Delta S_{total} = 0$
C $\Delta U = 0, \Delta S_{total} \neq 0$ **D** $\Delta U \neq 0, \Delta S_{total} \neq 0$

Q38. The bond dissociation energies of H_2, Cl_2, and HCl are 104, 58 and 103kcal mol^{-1} respectively. The enthalpy of formation of HCl would be: **1 Mark**

A -22kcal mol^{-1} **B** -44kcal mol^{-1} **C** +44kcal mol^{-1} **D** +22kcal mol^{-1}

Q39. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: Internal energy is an extensive property.
Reason: Internal energy depends upon the amount of the system.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false.
D Both Assertion and Reason are false.

Q40. Which of the following expression is correct for a reversible process in a state of equilibrium? **1 Mark**

A $\Delta G = -2.30RT \log K$ **B** $\Delta G = 2.30RT \log K$
C $\Delta G^\circ = -2.303RT \log K$ **D** $\Delta G^\circ = 2.303RT \log K$

Q41. All natural processes are: **1 Mark**

A Spontaneous **B** Non- spontaneous **C** Exothermic **D** Endothermic

Q42. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: A process is called adiabatic if the system does not exchange heat with the surroundings.
Reason: It does not involve increase or decrease in temperature of the system.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false.
D Both Assertion and Reason are false.

Q43. The enthalpy of vapourisation of a liquid is 30kJ mol^{-1} and enthalpy of vapourisation is 75J mol^{-1}. The boiling point of the liquid at 1atm is: **1 Mark**

A 250K. **B** 400K. **C** 450K. **D** 600K.

Q44. The volume of gas is reduced to half from its original volume. The specific heat will be _____. **1 Mark**

A Reduce to half. **B** Be doubled. **C** Remain constant. **D** Increase four times.

Q45. When we take acetone in a test tube it feels cold. Which reaction occurs in the process? **1 Mark**

A Endothermic reaction **B** Exothermic reaction **C** Reversible process **D** Adiabatic process

Q46. Two moles of an ideal gas is expanded isothermally and reversibly from 1L to 10L at 300K. The enthalpy change (in kJ) for the process is: **1 Mark**

A 11.4kJ **B** -11.4kJ **C** 0kJ **D** 4.8kJ

Q47. Which of the following endothermic processes are spontaneous? **1 Mark**

A Melting of ice **B** Evaporation of water **C** Heat of combustion **D** Both (a) and (b)

Q48. The total heat content of a system is: **1 Mark**

A Entropy **B** Free energy **C** Enthalpy **D** Kinetic energy

Q49. The important considerations in deciding if a reaction will be spontaneous are : **1 Mark**

A Stability & state of reactants
B Energy gained & heat evolved
C Exothermic energy & randomness of the products
D Endothermic energy & randomness of the products
E Endothermic energy & structure of the products

Q50. The internal energy of a compressed real gas, as compared to that of the normal gas at the same temperature, is: **1 Mark**

A Less
B More
C Sometimes less, sometimes more
D None of these

Q51. No work is done on the system, but q amount of heat is taken out from the system and given to the surrounding. The change in internal energy of a system is: **1 Mark**

A $\Delta U = -q$
B $\Delta U = +q$
C $\Delta U = W_{ad}$
D $\Delta U = q - W$

Q52. The value of $\Delta_r G^\circ$ is equal to: **1 Mark**

A $-2.303RT \log K$
B $+2.303RT \log K$
C $\Delta_r H^\circ - T\Delta_r S^\circ$
D Both (a) and (c).

Q53. A gas is allowed to ospand in a well insulated container against a cemstant eternal pressure of 2.5atm from an initial volume of 2.50L to a final volume of 4.50L The change in internal energy in Joule's will he: **1 Mark**

A -500J **B** -506J **C** +505J **D** 1136.25J

Q54. The enthalpy change when one mole of solute dissolves in a specified amount of solvent is called: **1 Mark**

A Enthalpy of dilution.
B Enthalpy of solution.
C Enthalpy of association.
D Enthalpy of dissociation.

Q55. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: T, P and V are state variables or state functions.
Reason: Their values depend on the state of the system and how it is reached

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false.
D Both Assertion and Reason are false.

Q56. The correct thermodynamic conditions for the spontaneous reaction at all temperature is: **1 Mark**

A $\Delta H < 0$ and $\Delta S > 0$
B $\Delta H < 0$ and $\Delta S < 0$
C $\Delta H < 0$ and $\Delta S = 0$
D $\Delta H > 0$ and $\Delta S < 0$

Q57. The enthalpies of all elements in their standard states are: **1 Mark**

A Unity.
B Zero.
C < 0.
D Different for each element.

Q58. You are given a lump of an unknown metal. You perform an experiment and figure out the specific heat is close to 0.89 J/g oC. What could be the identity of the metal? **1 Mark**

A Gold **B** Silver **C** Iron **D** Aluminum
E None of the above

Q59. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: There is exchange in internal energy in a cyclic process.
Reason: Cyclic proces is the one in which the sytem returns to its initial state after a number of reactions.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false.
D Both Assertion and Reason are false.

Q60. Energy hidden in a definite quantity of substance is: **1 Mark**

A Enthalpy **B** Internal energy **C** Free energy **D** Entropy

Q61. In a thermodynamic system working subtance is ideal gas, its internal energy is in the from of: **1 Mark**

A Kinetic energy only
B Kinetic and potential energy
C Potential energy
D None of these

Q62. For the given reaction, $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ the correct expression for $\Delta_r H$ is: **1 Mark**

A $[H_m(CO_2, g) + 2H_m(O_2, g)] - [2H_m(H_2O, l) + H_m(CH_4,\ g)]$
B $[2H_m(O_2, g) + H_m(CH_4, g)] - [H_m(CO_2, g) + 2H_m(H_2, O, l)]$
C $[H_m(CO_2, g) + 2H_m(H_2O, l)] - [H_m(CH_4, g) + 2H_m(O_2,\ g)]$
D $[H_m(CO_2, g) + H_m(H_2O, l)] - [H_m(CH_4, g) + 2H_m(O_2,\ g)]$

Q63. The statement "The change of enthalpy of a chemical reaction is same whether the reaction takes place in one or several steps" is: **1 Mark**

A Le Chatelier's law
B van't Hoff's law
C first law of thermodynamics
D Hess's law.

Q64. Hess's law is related to: **1 Mark**

A Change in heat during a reaction
B Rates of reaction
C Equilibrium constant
D Influence of pressure on volume of a gas

Q65. Hess law of heat summation includes: **1 Mark**

A Initial reactants only
B Initial reactants and final products
C Final products only
D Intermediates only

Q66. The amount of heat required to raise the temperature of a substance through 1oC is called: **1 Mark**

A Thermal energy **B** Calories **C** Heat capacity **D** Specific heat capacity

Q67. The mathematical expression of first law of thermodynamics is: **1 Mark**

A $\Delta U = q$
B $\Delta U = W$
C $\Delta U = q + W$
D $\Delta U = W_{ad}$

Q68. The enthalpies of elements in their standard states are taken as zero.The enthalpy of formation of a compound. **1 Mark**

A Is always negative.
B Is always positive.
C May be positive or negative.
D Is never negative.

Q69. Thermodynamics is not concerned about _____. **1 Mark**

A Energy changes involved in a chemical reaction.
B The extent to which a chemical reaction proceeds.
C The rate at which a reaction proceeds.
D The feasibility of a chemical reaction.

Q70. Specific heat may be defined as: **1 Mark**

A Heat capacity at constant volume
B Heat capacity at constant pressure
C Heat capacity mol^{-1}
D Heat capacity g^{-1}

Q71. The internal energy U is a unique function of any state because change in U: **1 Mark**

A Does not depends upon path
B Depends upon path
C Corresponds to adiabatic process
D Corresponds to an isothermal process

Q72. In a cyclic process, the change in the internal energy of a system over one complete cycle: **1 Mark**

A depends on the path **B** is always negative **C** is always zero **D** is always positive

Q73. The temperature at the bottom of a high water fall is higher than that at the top because: **1 Mark**

A by itself heat flows from higher to lower temperature
B the difference in height causes a difference in pressure
C thermal energy is transformed into mechanical energy
D mechanical energy is transformed into thermal energy

Q74. Which of the following processes is a nonspontaneous process? **1 Mark**

A Dissolution of salt or sugar in water
B Mixing of different gases through diffusion
C Precipitation of copper when zinc rod is dipped in aqueous solution of copper sulphate
D Flow of heat from a cold body to a hot body in contact of these

Q75. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**

Assertion: The mass and volume of a substance are the extensive properties and are proportional to each other.

Reason: The ratio of mass of a sample to its volume is an intensive property.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false.
D Both Assertion and Reason are false.

Q76. A spontaneous reaction occurs: **1 Mark**

A by itself and quickly
B with outside intervention and quickly
C by itself and slowly
D with outside intervention and slowly
E by itself but it has now effect on how fast the reaction takes

Q77. Consider the reactions given below. On the basis of these reactions find out which of the algebric relations given in options (i) to (iv) is correct? **1 Mark**

1. $\mathrm{C(g) + 4H(g) \rightarrow CH_4(g); \Delta_r H = xkJ\ mol^{-1}}$
2. $\mathrm{C(graphite,s) + 2H_2(g) \rightarrow CH_4(g); \Delta_r H = ykJ\ mol^{-1}}$

A $\mathrm{x = y}$
B $\mathrm{x = 2y}$
C $\mathrm{x > y}$
D $\mathrm{x < y}$

Q78. Internal energy per mole of gas depends on **1 Mark**

A Viscosity **B** Density **C** Temperature **D** Thermal conductivity

Q79. Which statement about reactions that produce heat is not correct? **1 Mark**

A Burning magnesium produces hear energy
B The overall reaction is exothermic
C The products have more energy than the reactants
D The temperature of the surroundings increases

Q80. Thermodynamics is the branch of science concerned with ____ and _____ and their relation to energy and work: **1 Mark**

A Heat, temperature **B** Tmperature, pressure **C** Heat, volume **D** Volume, pressure

Q81. Whether a reaction is endothermic or exothermic can be indicated by: **1 Mark**

A Enthalpy change.
B Entropy change.
C Gibbs free energy change.
D Activation energy.
E Specific heat capacity.

Q82. A thermochemical equation: **1 Mark**

A Includes only the balanced chemical reaction
B Includes the balanced chemical reaction and change in enthalpy value
C Includes only the change in enthalpy value
D None of these options
E Includes the unbalanced chemical reaction and change in enthalpy value

Q83. Consider the following reaction between zinc and oxygen and choose the correct options out of the options given below: **1 Mark**

$$2Zn(s) + O_2(g) \rightarrow 2ZnO(s);\ \Delta H = -693.8 kJ\ mol^{-1}$$

A The enthalpy of two moles of ZnO is less than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8kJ.
B The enthalpy of two moles of ZnO is more than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8kJ.
C 693.8kJ mol^{-1} energy is evolved in the reaction.
D 693.8kJ mol^{-1} energy is absorbed in the reaction.

Q84. For a reaction to be spontaneous, the sign on delta G should be : **1 Mark**

A positive
B There should be no sign
C Negative
D Spontaneity is not related to Gibbs Free Energy
E Positive or Negative

Q85. Which of the following statements is not correct? **1 Mark**

A For a spontaneous process, ΔG must be negative.
B Enthalpy, entropy, free energy etc. are state variables.
C A spontaneous process is reversible in nature.
D Total of all possible kinds of energy of a system is called its internal energy.

Q86. For an ideal gas, the work of reversible expansion under isothermal condition can be calculated by using the expression $= -nRTln\frac{V_f}{V_t}$ A sample containing 1.0mol of an ideal gas is expanded isothermally and reversibly to ten times of its original volume, in two separate experiments. The expansion is carried out at 300K and at 600K respectively. Choose the correct option. **1 Mark**

A Work done at 600K is 20 times the work done at 300K.
B Work done at 300K is twice the work done at 600K.
C Work done at 600K is twice the work done at 300K.
D $\Delta U = 0$ in both cases.

Q87. What will be the value of logarithm of equilibrium constant K_P if the standard free energy change of a reaction is $\Delta G^\circ = -115kJ$ at 298K will be: **1 Mark**

A 2.303
B 13.83
C 2.015
D 20.15

Q88. What describes a spontaneous reaction? **1 Mark**

A Positive ΔH
B Negative ΔH
C Positive ΔG
D Negative ΔG

Q89. Which of the following is technique used to measure the heat of a reaction? **1 Mark**

A Gibbs Free Energy
B Entropy
C Enthalpy
D Calorimetry

Q90. Enthalpy change for the reaction, $4H(g) \rightarrow 2H_2(g)$ is -869.6kJ, **1 Mark**
The dissociation energy of H-H bond is:

A -869.6kJ
B +434.8kJ
C +217.4kJ
D -434.8kJ

Q91. Which one of the following process is non-spontaneous? **1 Mark**

A Dissolution of $CuSO_4$ in water
B Reaction of H_2 and O_2 to form water
C Water flowing down hill
D Flow of electric current from low potential to high potential

Q92. The thermal motion means: **1 Mark**

A Motion due to heat engine
B Disorderly motion of the body as a whole
C Motion of the body that generates heat
D Random motion of molecules

Q93. Which of the following can be calculated from Born-Haber cycle for Al_2O_3? **1 Mark**

A Lattice energy of Al_2O_3
B Electron affinity of O-atom
C Ionisation energy of Al
D All of these

Q94. What is the change in the energy of system if 500cal of heat energy are added to a system and system does 350cal of work on the surroundings? **1 Mark**

A -150cal **B** +150cal **C** +850cal **D** -850cal

Q95. For a thermodynamics process to be reversible, the temperature difference between hot body and the working substance should be: **1 Mark**

A zero **B** minimunm **C** maximum **D** infinity

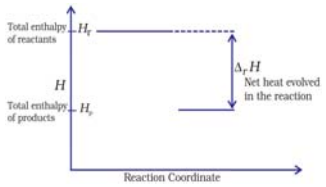
Q96. If there were no atmosphere, the average temperature on earth surface would be: **1 Mark**

A lower **B** higher **C** same **D** 0^oC

Q97. Lattice enthalpies are determined by: **1 Mark**

A Born-Haber cycle. **B** Hess' law. **C** Lattice cycle. **D** None of these.

Q98. **1 Mark**



The above diagram represents:

A Enthalpy for exothermic reactions.
B Enthalpy for endothermic reactions.
C Entropy for exothermic reactions.
D Entropy for endothermic reactions.

Q99. Two substances P and Q when brought together, form substance R with the evolution of heat. The properties of R are different from both P and Q. What is substance R? **1 Mark**

A A compound **B** An element **C** A metal **D** A mixture

Q100. The reaction 2A(g)→A2(g), will be spontaneous: **1 Mark**

A At high temperature
B At low temperature
C At all temperature
D Never at any temperature

Q101. Which of the following is not a thermodynamic coordinate? **1 Mark**

A Gas constant (R) **B** Pressure (P) **C** Volume (V) **D** Temperature (T)

Q102. Select the incorrect expression from the following. **1 Mark**

A $\Delta S_{total} = \Delta S_{system} + \Delta S_{surr}$
B $\Delta S_{surr} = \frac{\Delta H_{surr}}{T} = -\frac{\Delta H_{sys}}{T}$
C $\Delta S_{total} < 0$ (spontaneous process)
D $\Delta G = \Delta H - T\Delta S$

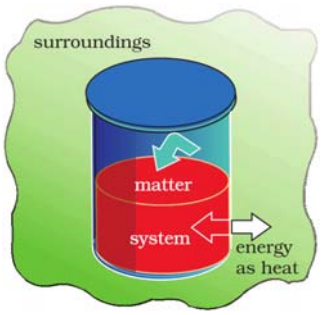
Q103. What is multiplied by temperature in the equation that calculates free energy? **1 Mark**

A Positive ΔH **B** Negative ΔH **C** Positive ΔG **D** Negative ΔG
E Positive ΔS

Q104. Hess's law of constant heat summation in based on: **1 Mark**

A $E = mc^2$
B Conservation of mass
C First law of thermodynamics
D None of the above

Q105. **1 Mark**



Name the type of wall used in the above figure.

A Adiabatic walls.
B Thermally insulating walls.
C Thermally conducting walls.
D None of the above.

Q106. Hess law is based on: **1 Mark**

A Law of conservation of mass
B Law of conservation of energy
C Enthalpy is a state function
D None of these

Q107. The internal energy of a perfect gas depends on: **1 Mark**

A Pressure **B** Temperature **C** Volume **D** Specific heat

Q108. $\Delta_f U^{\ominus}$ of formation of $CH_4\ (g)$ at certain temperature is $-393\ kJ\ mol^{-1}$. The value of $\Delta_f H^{\ominus}$ is: **1 Mark**

A Zero
B $< \Delta_f U^{\ominus}$
C $> \Delta_f U^{\ominus}$
D $\text{Equal to } \Delta_f U^{\ominus}$

Q109. The internal energy of a perfect gas is: **1 Mark**

A Completely kinetic
B Completely potential
C Sum of potential and kinetic energy of the molecules
D Difference of kinetic and potential energy of the molecules

Q110. A quantity that cannot be directly measured is: **1 Mark**

A Heat of formation of $H_2O(l)$
B Heat of formation of $CH_4(g)$
C Latent heat of fusion of ice
D Heat of combustion of ethyl alcohol

Q111. Which of the following is not correct? **1 Mark**

A ΔG is zero for a reversible reactio.
B ΔG is positive for a spontaneous reactio.
C ΔG is negative for a spontaneous reaction.
D ΔG is positive for a non-spontaneous reaction.

Q112. Which heat depends on the direction of current? **1 Mark**

A Joule heat **B** Peltier heat **C** Thompson effect **D** None of these

Q113. Free energy change for the process A(s) ⇌ B(l) will be: **1 Mark**

A 0 **B** 1 **C** 2 **D** 3

Q114. Which of the following, is correct when decrease in entropy has been taken place? **1 Mark**

A Temperature of a crystalline solid is raised from 0K to 115K.
B A liquid crystallises into a solid.
C $2NaHCO_3(s) \xrightarrow{\Delta} Na_2CO_3(s) + CO_2(g) + H_2O(g)$
D $H_2(g)$? 2H(g)

Q115. The state of gas can be described by quoting the relationship between: **1 Mark**

A Pressure, volume, temperature.
B Temperature, amount, pressure.
C Amount, volume, temperature.
D Pressure, volume, temperature, amount.

Q116. Which of the following is most likely to produce a spontaneous reaction? **1 Mark**

A Negative Enthalpy
B Positive Enthalpy
C Negative Entropy
D Positive Entropy
E Negative Enthalpy and positive Entropy

Q117. **1 Mark**

The heat released when the requisite amount of ions in the gaseous state combine to give 1 mol of crystal lattice is known as:

A lattice energy **B** hydration energy **C** formation energy **D** none of the above

Q118. For an ideal solution containing two liquid components A and B, the Gibbs free energy of mixing is minimum, when the molar ratio of the liquids is: **1 Mark**

A 1 : 1 **B** 1 : 2 **C** 1 :10 **D** 1 : 1000

Q119. Hess's law is based on: **1 Mark**

A Law of conservation of mass. **B** Law of conservation of energy.
C Law of active mass. **D** Both (a) and (b).

Q120. Which heat is produced throughout the conducting wire? **1 Mark**

A Petlier heat **B** Thomson effect heat **C** Joule heat **D** none of these

Q121. The sign of ΔG for a spontaneous and non-spontaneous process respectively are: **1 Mark**

A Positive and negative. **B** Negative and positive. **C** Zero and positive. **D** Positive and zero.

Q122. Mixture of ice and water is form a: **1 Mark**

A Closed system **B** Open system **C** Isolated system **D** Heterogeneous system

Q123. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: When a solid melts, decrease in enthalpy is observed.
Reason: Melting of a solid is endothermic.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion. **B** Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false **D** Both Assertion and Reason are false.

Q124. Regarding a thermochemical equation, wrong statement is: **1 Mark**

A It tells about the physical states of reactants and products **B** It tells whether the reaction is exothermic or endothermic
C It tells about the allotropic form (if any) of the reactant **D** It tells whether the reaction is possible or not

Q125. For the reaction, $\mathrm{N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g);\ \Delta H}$ is: **1 Mark**

A $\Delta \mathrm{U} - 2\mathrm{RT}$ **B** $\Delta \mathrm{U} - \mathrm{RT}$
C $\Delta \mathrm{U} + \mathrm{RT}$ **D** $\Delta \mathrm{U} + 2\mathrm{RT}$

Q126. Which of the following is slow process: **1 Mark**

A Isothermal **B** Adiabatic **C** Isobaric **D** None of these

Q127. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: Many endothermic reactions that are not spontaneous at room temperature become spontaneous at high temperature.
Reason: Entropy of the system increases with increase in temperature.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion. **B** Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C Assertion is true but Reason is false. **D** Both Assertion and Reason are false.

Q128. Name the apparatus used to measure the heat absorbed or released by a reaction: **1 Mark**

A Centrifuge **B** Barometer **C** Balance **D** Calorimeter
E Battery

Q129. The entropy change can be calculated by using the expression $\Delta S = \frac{q_{rev}}{T}$. When water freezes in a glass beaker, choose the correct statement amongst the following: **1 Mark**

A $\Delta S_{(system)}$ decreases but $\Delta S_{(surrounding)}$ remains the same.
B $\Delta S_{(system)}$ increases but $\Delta S_{(surrounding)}$ decreases.
C $\Delta S_{(system)}$ decreases but $\Delta S_{(surrounding)}$ increases.
D $\Delta S_{(system)}$ decreases but $\Delta S_{(surrounding)}$ also decreases.

Q130. $\Delta S(A \rightarrow C) = 50ev$, **1 Mark**
$\Delta S(C \rightarrow D) = 30ev$,
$\Delta S(B \rightarrow D) = 20ev$
$A \rightarrow B$
$\downarrow \quad \uparrow$
$C \rightarrow D$
The entropy change for A → B would be:

A 100ev **B** 60ev **C** -60ev **D** -100ev

Q131. A liquid boils at such a temperature at which the saturated vapour pressure, as compared to atmospheric pressure, is : **1 Mark**

A One-third **B** Equal **C** Half **D** Double

Q132. Based on knowledge of solid compounds and bond strengths, which of the following reactions is considered non-spontaneous due to the extremely high activation energy but once started becomes extremely spontaneous? **1 Mark**

A Dissolution of sodium hydroxide.
B Creating a dilution of hydrochloric acid.
C The burning of $C_{20}H_{42}$.
D The synthesis of silver oxide.

Q133. Combustion is: **1 Mark**

A Exothermic reaction **B** Endothermic reaction **C** Addition reaction **D** None of these

Q134. Calculate the difference between C_P and C_V for 10 moles of an ideal gas. **1 Mark**

A 83.14J **B** 8.314J **C** 831.4J **D** 0.831J

Q135. The heat measured for a reaction in bomb calorimeter is : **1 Mark**

A ΔG **B** ΔH **C** ΔU **D** PΔV

Q136. Which of the following properties is the measure of the degree of randomness or disorder in the system? **1 Mark**

A Entropy. **B** Enthalpy. **C** Internal energy. **D** None of these.

Q137. Internal energy does not include: **1 Mark**

A Vibrational energy
B Rotational energy
C Energy arising by gravitational pull
D Nuclear energy

Q138. For the process to occur under adiabatic conditions, the correct condition is: **1 Mark**

A $\Delta T = 0$ **B** $\Delta p = 0$ **C** $q = 0$ **D** $w = 0$

Q139. Hess's law is applicable for the determination of heat of: **1 Mark**

A Reaction **B** Transition **C** Formation **D** All of the above

Q140. Which one of the following reaction has ΔS° greater than zero? **1 Mark**

A $CaO + CO_2(g) \rightleftharpoons CaCO_3(s)$
B $NaCl(aq) \rightleftharpoons NaCl(s)$
C $NaNO_3(s) \rightleftharpoons Na^+(aq) + NO_3^-(sq)$
D $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

Q141. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**
Assertion: First law of thermodynamics is applicable to an electric fan or a heater.
Reason: In an electric fan, the electrical energy is converted into mechanical work that moves the blades. In a heater, electrical energy is converted into heat energy.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C Assertion is true but Reason is false.

D Both Assertion and Reason are false.

Q142. Which specific process has negative value of specific heat? **1 Mark**

A Saturated vapours **B** Ice **C** Water **D** Vapours

Q143. At the boiling point of water the saturated vapour pressure will be (in mm of Hg): **1 Mark**

A 750 **B** 760 **C** 850 **D** 860

Q144. Hess's law is used to calculate: **1 Mark**

A Enthalpy of reaction **B** Entropy of reaction **C** Work done in reaction **D** All the above

Q145. Which of the following parameters does not charaterize the thermodynamic state of matter? **1 Mark**

A temperature **B** pressure **C** work **D** volume

Q146. The heat required to raise the temperature of a body by 1K is called: **1 Mark**

A Specific heat **B** Thermal capacity **C** Water equivalent **D** None of these

Q147. Magnitude of Seebeck emf between the junctions does not depend on: **1 Mark**

A Thermocouple

B Temperature of cold junction

C Temperature of hot function

D Neutral temperature

Q148. Which of the following statements is correct? **1 Mark**

A The presence of reacting species in a covered beaker is an example of open system.

B There is an exchange of energy as well as matter between the system and the surroundings in a closed system.

C The presence of reactants in a closed vessel made up of copper is an example of a closed system.

D The presence of reactants in a thermos flask or any other closed insulated vessel is an example of a closed system.

Q149. For which of the following processes ΔS is negative? **1 Mark**

A $H_2(g)$?2H(g)

B N_2(g, 1atm) ? N_2(g, 5atm)

C $2SO_3(g)$? $2SO_2(g) + O_2(g)$

D C(diamond) ? C(graphite)

Q150. According to Hess's law, the heat of reaction depends upon: **1 Mark**

A Initial condition of reactants

B Initial and final conditions of reactants

C Intermediate path of the reaction

D End conditions of reactants

Q151. Which of the following process is non-spontaneous? **1 Mark**

A Heat flow from hot end to cool end.

B Water flow from higher level to lower level.

C Gas flow from lower pressure region to higher pressure region.

D Gas flow from higher pressure region to lower pressure region.

Q152. How many joules of heat are absorbed when 70.0g of water is completely vaporised at its boiling point? [Take : LV = 2260kJ/ kg] **1 Mark**

A 22352 **B** 52460 **C** 22344 **D** 158200

Q153. During complete combustion of one mole of butane, 2658kJ of heat is released. The thermochemical reaction for above change is: **1 Mark**

A $2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)\Delta_cH = -2658.0kJ\ mol^{-1}$

B $C_4H_{10}(g) + \frac{13}{2}O_2(g) \rightarrow 4CO_2(g) + 5H_2O(g)\Delta_cH = -1329.0kJ\ mol^{-1}$

C $C_4H_{10} + \frac{13}{2}O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)\Delta_cH = -2658.0kJ\ mol^{-1}$

D $C_4H_{10}(g)\frac{13}{2}O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)\Delta_c = +2658.0kJ\ mol^{-1}$

Q154. For a spontaneous process: **1 Mark**

A enthalpy change of the system must be negative
B entropy change of the system must be positive
C entropy change of the surrounding must be positive
D entropy change of the system plus surrounding must be positive

Q155. The spontaneity means, having the potential to proceed without the assistance of external agency. The processes which occur spontaneously are: **1 Mark**

A Flow of heat from colder to warmer body.
B Gas in a container contracting into one corner.
C Gas expanding to fill the available volume.
D Burning carbon in oxygen to give carbon dioxide.

Q156. The reverse of a spontaneous reaction is ..... : **1 Mark**

A always spontaneous
B always non spontaneous
C sometimes spontaneous
D sometimes non spontaneous
E There is no way of telling

Q157. In an exothermic reaction, heat is evolved, and system loses heat to the surrounding.For such system: **1 Mark**

A q_p will be negative.
B $\Delta_r H$ will be negative.
C q_p will be positive.
D $\Delta_r H$ will be positive.

Q158. Which of the following property is not a thermodynamic property of the system? **1 Mark**

A pressure **B** temperature **C** specific volume **D** heat

Q159. For the reaction, $NaCl(s) \rightarrow Na^+(g) + Cl^-(g)$ **1 Mark**
Identify the enthalpy involved in the above reaction:

A Enthalpy of hydration.
B Lattice enthalpy.
C Enthalpy of solution.
D Enthalpy of dissociation.

Q160. The internal energy of a piece of lead when beaten by a hammer will: **1 Mark**

A Increase
B Decrease
C Remain constant
D Sometimes increases and sometimes decreases

Q161. If the sublimation energy and enthalpy of fusion of I_2 are 57.3kJ mol^{-1} and 15.5kJ mol^{-1}, respectively then, calculate the enthalpy of vaporisation of I_2. **1 Mark**

A -72.8kJ mol^{-1} **B** 72.8kJ mol^{-1} **C** -41.8kJ mol^{-1} **D** +41.8kJ mol^{-1}

Q162. Which of the following is an endothermic process? **1 Mark**

A $2H_2 + O_2 \rightarrow 2H_2O;\ \Delta H = -q\ kJ$
B $N_2 + O_2 \rightarrow 2NO - Y\ kJ$
C $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O;$ $\Delta H = -X\ kJ\ mol^{-1}$
D $NaOH + HCl \rightarrow NaCl + H_2O + Z\ kJ$

Q163. Thermodynamics mainly deals with: **1 Mark**

A Interrelation of various forms of energy and their transformation from one form to another.
B Energy changes in the processes which depend only on initial and final states of the microscopic systems containing a few molecules.
C How and at what rate these energy transformations are carried out.
D The system in equilibrium state or moving from one equilibrium state to another equilibrium state.

Q164. The energy of a system available to do work is called as: **1 Mark**

A Gibbs free energy
B Heat of formation
C Specific heat
D Heinsenberg uncertainty principle
E Heat of vaporization

Q165. What can be used in combination with a calorimeter to compare the specific heats of two substances? **1 Mark**

A Thermometer **B** Conductivity tester **C** Graduated cylinder **D** Buret

E Salt bridge

Q166. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following: **1 Mark**

Assertion: For an isothermal reversible process Q = –W i.e. work done by the system equals the heat absorbed by the system.

Reason: Enthalpy change ('H) is zero for isothermal process.

A Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C Assertion is true but Reason is false.

D Both Assertion and Reason are false.

Q167. If the bond energies of H-H, Br-Br and H-Br are 433, 192 and 364kJ mol^{-1}, respectively, then ΔH° for the reaction. **1 Mark**

$H_2(g) + Br(g) \rightarrow 2HBr(g)$ is:

A -261kJ **B** -103kJ **C** +261kJ **D** -1031kJ

Q168. What is the characteristic of a material which undergo spontaneous combustion? **1 Mark**

A High calorific value

B High vapour pressure

C Low ignition temperature

D All of the above

Q169. For a given reaction, $\Delta H = 35.5 kJ\ mol^{-1}$ and $\Delta S = 83.6 Jk^{-1} mol^{-1}$. The reaction is spontaneous at (assume that ΔH and ΔS do not vary with temperature): **1 Mark**

A T > 425K **B** All temperature. **C** T > 298K **D** T < 425K